

NON-PUBLIC?: N  
ACCESSION #: 9503200375  
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Browns Ferry Nuclear Plant (BFN) Unit 2 PAGE: 1 OF 7

DOCKET NUMBER: 05000260

TITLE: Reactor scram resulting from a turbine trip due to a  
sensed generator load unbalance condition caused the  
actuation of the ESF system.  
EVENT DATE: 02/09/95 LER #: 95-002-00 REPORT DATE: 03/10/95

OTHER FACILITIES INVOLVED: NA DOCKET NO: 05000

OPERATING MODE: N POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR  
SECTION:  
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:  
NAME: James E. Wallace, Compliance TELEPHONE: (205) 729-7874  
Licensing Engineer

COMPONENT FAILURE DESCRIPTION:  
CAUSE: SYSTEM: COMPONENT: MANUFACTURER:  
REPORTABLE NPRDS:

SUPPLEMENTAL REPORT EXPECTED: NO

#### ABSTRACT:

On February 9, 1995, at 0028 hours, the Unit 2 reactor scrammed due to a turbine trip. This trip was a result of a sensed generator load unbalance condition. The scram then resulted in the automatic actuation of the engineered safety feature (ESF) system. This event is, therefore, reportable in accordance with 10 CFR 50.73 (a)(2)(iv) as a condition responsible for an automatic actuation of the ESF system. The root cause of the event was a degraded subcomponent. Specifically, a leaking cooling water line manifold dripped water on the rectifier circuitry potentially creating a path to ground. Additionally, two generator field rectifier banks had a low-resistance to ground condition. Corrective actions to preclude recurrence are: (1) the leaking cooling water line was replaced, and (2) a determination will be performed for additional corrective actions based on a failure analysis of the leaking cooling

water manifold and analytical tests of the rectifier cooling water tubes.

END OF ABSTRACT

TEXT PAGE 2 OF 7

## I. PLANT CONDITIONS

At the time this event was discovered, Unit 2 had been operating at 100 percent power for 66 days. Units 1 and 3 were shutdown and defueled.

## II. DESCRIPTION OF EVENT

### A. Event

At 0028 hours Central Standard Time (CST) on February 9, 1995, Unit 2 experienced a reactor scram while the unit was at full power. The Unit 2 main generator field ground relay TL, RLY! actuated and provided a Unit 2 main generator exciter ground alarm in the control room due to a grounding condition. The generator output breaker TL, BKR! (PCB224) opened after a generator load unbalance was sensed. Subsequently, a generator load reject signal caused the turbine control valves (TCV) FCV! to fast close because the turbine first stage pressure was greater than 154 psig. The TCV fast closure resulted in a reactor scram signal.

This reactor scram actuated the primary containment isolation system, specifically, group 2- shutdown cooling mode of the residual heat removal system BO!; group 3- reactor water cleanup system CE!; group 6- primary containment purge and vent JM!, Unit 2 reactor zone ventilation VB!, refueling zone ventilation VA!, standby gas treatment System BH! initiation, and control room emergency ventilation VI! initiation; and group 8- transverse in-core probes IG! withdrawal.

On February 10, at 0657 hours CST the reactor was restarted and synchronized to the TVA system grid.

This event is reportable in accordance with 10 CFR 50.73 (a)(2)(iv) as a condition responsible for an automatic actuation of the ESF system.

B. Inoperable Structures, Components, or Systems that Contributed to the Event:

None.

TEXT PAGE 3 OF 7

C. Dates and Approximate Times of Major Occurrences:

February 9, 1995 at 0028 CST The Unit 2 reactor scrammed due to a turbine trip. The Unit 2 emergency operating instruction (2-EOI-1) was entered because of a low reactor water level.

February 9, 1995 at 0030 Reactor water level was normalized, Unit 2 was stable, and 2-EOI-1 was exited.

February 9, 1995 at 0225 TVA provided a 10 CFR 50.72(A)(2)(ii) notification to NRC operations center that the reactor scrammed and the ESFs automatically actuated.

February 9, 1995 at 2000 Control rods were being pulled to restart the Unit 2 reactor.

February 10, 1995 at 0657 The reactor was restarted and synchronized to the TVA system grid.

D. Other Systems or Secondary Functions Affected.

None.

E. Method of Discovery:

This condition was discovered when the control room received the Unit 2 main generator exciter ground alarm and subsequent turbine and reactor trips.

F. Operator Actions:

Once the reactor scrammed, operations personnel licensed, utility! entered 2-EOI-1 to control the reactor for a low reactor water level condition. Operations personnel then responded to the scram in accordance with the approved reactor

scram procedure (2-AOI-100-1), and the reactor was stabilized within two minutes. The EOI was then exited.

TEXT PAGE 4 OF 7

#### G. Safety System Responses:

All safety systems responded as designed for this type of event.

### III. CAUSE OF THE EVENT

#### A. Immediate Cause:

The immediate cause of the event was the Unit 2 main generator exciter ground relay activated eventually resulting in a reactor scram.

#### B. Root Cause:

TVA's investigation of this event determined that the cause of the event was a degraded subcomponent. Specifically, a stator cooling water leak from the top of the generator field rectifying cooling water manifold in PRC 1 (See Figure 1) dripped on rectifier components potentially creating a path to ground. Additionally, two generator field PRCs (2 and 5) had a low-resistance to ground state due to internal deposition of corrosion products (copper oxides) in their teflon insulating tubes.

### IV. ANALYSIS OF THE EVENT

The BFN FSAR contains an analysis of a generator load reject/scram transient. In that transient, the FSAR assumes a starting point of greater than 100 percent power and associated steam flow. The analysis also assumes that the turbine bypass valves fail to open. Plant Systems are designed to respond to such a transient. This LER event was much less severe than the analyzed FSAR transient. Thus, this event was bounded by the plant safety analysis.

The main generator PRCs take the AC output voltage of the alternator exciter and rectifies it to produce a DC voltage which is applied to the main generator. Each rectifier circuit contains diodes that are mounted on a rectangular copper heat sink through which deionized water from the generator cooling system is circulated. The deionizing water is carried between heat sinks through metal piping

and teflon insulating tubes which also serve as electrical insulation from ground. The "as found" condition revealed two anomalies: (1) a water leak from the upper metal manifold in PRC 1, and (2) low-resistance path to ground in two cubicles (PRCs 2 and 5).

TEXT PAGE 5 OF 7

During this event, the turbine and reactor protective systems actuated as designed to mitigate a scram from 100 percent power, and operations personnel actions brought the reactor to a stable condition within two minutes to minimize the effect of the plant scram. Consequently, the plant parameters remained well within the bounds of the BFN safety analysis. Therefore, the health and safety of plant personnel and the public as a result of this event were not compromised.

## V. CORRECTIVE ACTIONS

### A. Immediate Corrective Actions:

Operations personnel responded to the reactor scram. Operations and Technical Support personnel isolated and meggered the main generator circuitry, and identified that PRCs 1, 3, 4, and 6 had a resistance of 10M ohms to ground while PRCs 2 and 5 had a resistance of 300K ohms and 100K ohms to ground, respectively. Associated circuitry included the Alterrex stator and PRC circuitry measured in the "as found" condition had 100K ohms of resistance to ground. When this electrical troubleshooting was being performed, a water leak was identified from the top of the PRC 1 cooling water line manifold onto rectifier components below. The PRCs 2 and 5 low-resistance conditions were eliminated by the cleaning/replacing of the teflon insulating tubes of the cooling water lines until a 1.5M ohms resistance was achieved in the associated circuitry.

### B. Corrective Actions to Prevent Recurrence:

Corrective actions to preclude recurrence are: (1) PRC 1 leaking cooling water line manifold was replaced, and (2) a determination will be performed for additional corrective actions based on a failure analysis of the leaking cooling water manifold and analytical tests of the rectifier cooling water tubes.

If the results of this analysis significantly alter either the root cause or corrective actions for this event, a supplemental report will be submitted.

## VI. ADDITIONAL INFORMATION

### A. Failed Components:

The main generator power rectifiers had multiple grounds as described in section III.

TEXT PAGE 6 OF 7

### B. Previous LERs on Similar Events:

LER 259/84024 provided details concerning a reactor scram resulting from a turbine-generator trip. The corrective action to preclude a recurrence was to reduce the size of the in-line filter to minimize the deposition of iron and copper onto the teflon insulating tube. Since that time, TVA has initiated a preventive maintenance task to chemically clean the teflon tubes every 36 months to further reduce the recurrence of this type of event. The change to reduce the size of the in-line filter would not have precluded this event (LER 260/95002).

## VII. Commitments

Not all actions described in section V of this report are Regulatory Commitments. That is, they are not actions required to restore compliance with obligations. Obligations mean an action that is a legal binding requirement imposed through applicable rules, regulations, orders, and licenses. The only commitment is identified below:

A determination will be performed for additional corrective actions based on a failure analysis of the leaking cooling water manifold and analytical tests of the rectifier cooling water tubes. This determination will be completed by June 16, 1995.

Energy Industry Identification System (EIIS) system and component codes are identified in the text with brackets (e.g., XX!).

TEXT PAGE 7 OF 7

FIGURE 1 "MAIN GENERATOR ASSEMBLY" omitted.

ATTACHMENT TO 9503200375 PAGE 1 OF 2

TVA

Tennessee Valley Authority, Post Office Box 2000,  
Decatur, Alabama 35609-2000

R. D. (Rick) Machon  
Vice President, Browns Ferry Nuclear Plant

March 10, 1995

U.S. Nuclear Regulatory Commission 10 CFR 50.73  
ATTN: Document Control Desk  
Washington, D.C. 20555

Dear Sir:

BROWNS FERRY NUCLEAR PLANT (BFN) - UNITS 1, 2, AND 3 - DOCKET NOS.  
50-259, 50-260, AND 296 - FACILITY OPERATING LICENSE DPR-33, 52, AND 68 -  
LICENSEE EVENT REPORT 50-260/95002

The enclosed report provides details concerning a reactor scram on  
February 9, 1995, that resulted from a turbine trip. The turbine trip  
occurred as part of a sensed generator load unbalance condition. The  
reactor scram subsequently resulted in actuating the engineered safety  
feature system.

This report is submitted in accordance with 10 CFR 50.73 (a)(2)(iv) as a  
condition that resulted in the automatic actuation of any engineered  
safety feature.

Sincerely,

R. D. Machon  
Site Vice President

Enclosure  
cc: See page 2

ATTACHMENT TO 9503200375 PAGE 2 OF 2

U.S. Nuclear Regulatory Commission  
Page 2  
March 10, 1995

Enclosure  
cc (Enclosure):  
INPO Records Center  
Suite 1500  
1100 Circle 75 Parkway  
Atlanta, Georgia 30339

Paul Krippner  
American Nuclear Insurers  
Town Center, Suite 300S  
29 South Main Street  
West Hartford, Connecticut 06107

NRC Resident Inspector  
Browns Ferry Nuclear Plant  
Route 12, Box 637  
Athens, Alabama 35611

Regional Administrator  
U.S. Nuclear Regulatory Commission  
Region II  
101 Marietta Street, NW, Suite 2900  
Atlanta, Georgia 30323

Mr. J. F. Williams, Project Manager  
U.S. Nuclear Regulatory Commission  
One White Flint, North  
11555 Rockville Pike  
Rockville, Maryland 20852

E. V. Imbro, NRR/RSIB  
U.S. Nuclear Regulatory Commission  
One White Flint, North  
11555 Rockville Pike  
Rockville, Maryland 20852

E. J. Leeds, NRR/DRPW  
U.S. Nuclear Regulatory Commission  
One White Flint, North  
11555 Rockville Pike  
Rockville, Maryland 20852

\*\*\* END OF DOCUMENT \*\*\*

---